2. MAY 1998 SCIENCE ADVISORY BOARD REVIEW AND AGENCY RESPONSES

On May 5 and 6, 1998, the Environmental Models Subcommittee (Subcommittee) of the Executive Committee of EPA's Science Advisory Board (SAB) held a meeting in Washington, DC to perform an early review of TRIM. At the time of the SAB review, only the conceptual approach for TRIM and a prototype of TRIM.FaTE had been developed. The Agency requested an early review of TRIM and the TRIM.FaTE prototype to ensure that the development of TRIM was conceptually sound and scientifically defensible as well as consistent with Agency objectives. Additional reviews of TRIM and its modules will be conducted by SAB over the next few years.

During the May 1998 SAB review, there were six charge questions related to TRIM and TRIM.FaTE.

1. Is the overall conceptual TRIM approach appropriate, given the underlying science, EPA policy, and regulatory needs (*i.e.*, what are the strengths and weaknesses)?

2. The TRIM approach is designed for the explicit treatment of uncertainty and variability, including both model uncertainty and parameter uncertainty. Is the spatial compartmental mass balance approach commensurate with quantifying uncertainty and variability in a scientifically defensible manner?

3. The TRIM.FaTE module is the environmental fate, transport, and exposure component of TRIM. Is the overall conceptual approach represented in the TRIM.FaTE module appropriate, given the underlying science, EPA policy, and regulatory needs (*i.e.*, what are the strengths and weaknesses of the approach)?

4. The TRIM approach is designed to be flexible and to allow for a tiered approach, to function as a hierarchy of models, from simple to complex, as needed.

   (a) As implemented at this time, is the TRIM.FaTE module, with its three-dimensional, spatial compartmental mass conserving approach to predicting the movement of pollutant mass over time, appropriate from a scientific perspective?

   (b) Is the TRIM.FaTE module, as designed, an appropriate tool, when run either at a screening level or for a more refined analysis, for use in providing information for regulatory decision-making? Given the module design (*i.e.*, the potentially large number of model parameters and associated uncertainty and variability), is TRIM.FaTE suitable to support regulatory decisions?

5. Does the TRIM.FaTE module, as it has been conceptualized, address some of the limitations associated with other models (*e.g.*, non-conservation of mass, steady-state approach, inability to quantify uncertainty and variability, limited range of receptors and

processes considered)? Are there other limitations that the TRIM.FaTE module should address?

6. Does the TRIM.FaTE module, as it has been conceptualized and demonstrated to date, facilitate future integration with appropriate data sources (*e.g.*, GIS) and applications (*e.g.*, multipathway exposure assessment for humans)?

The SAB responded to each of these questions and provided EPA with recommendations for improvements in the next versions of TRIM modules and TRIM.FaTE in particular (U.S. EPA 1998a). The SAB comments and Agency responses under each of the six charge questions are summarized below.

Overall, SAB found the development of TRIM and the TRIM.FaTE module to be conceptually sound and scientifically based. The SAB recommended that the TRIM team seek input from users before and after the methodology is developed to maximize its utility; understand the potential uses of TRIM to guard against inappropriate uses; provide documentation of recommended and inappropriate applications; provide training for users; test the model and its subcomponents against current data and models to evaluate its ability to provide realistic results; and apply terminology consistently.

2.1 IS THE OVERALL TRIM CONCEPTUAL APPROACH APPROPRIATE?

COMMENT: The SAB found the conceptual approach for TRIM to be technically defensible and appropriate for use in regulatory decision-making, but noted that because the system is evolving, it is unclear how the overall methodology will address the spectrum of regulatory questions. The SAB cited the flexibility of TRIM to be a strength, but also recommended that care be exercised to guard against developing unnecessarily complex or inconsistent modeling applications.

RESPONSE: The OAQPS agrees with the need to maintain the focus of TRIM uses on practical applications, recognizing that it is not intended to be a research model. The Office intends to provide clear documentation for those applications for which TRIM is an appropriate tool. Preparation of users guidance materials is planned for the next phase of TRIM development.

COMMENT: The SAB noted that the largest challenge facing TRIM is the lack of available data for estimating fate, transport, exposure, and risk processes, possibly limiting the ability of TRIM to model many chemicals and hindering model validation efforts. Therefore, SAB recommended identifying and acquiring significant additional field data (*e.g.*, air monitoring data, soil samples) to estimate modeling parameters and to "validate" the model components and other aspects of the modeling system.

RESPONSE: The OAQPS developed a strategy for model evaluation for TRIM, and the TRIM.FaTE module specifically, and identified existing data sets for potential use in implementing the approach, as discussed further in Section 4.8 and Chapters 6 and 7. This effort should facilitate the comparison of model results with "real world" environmental concentration data. Such a comparison is a key element of the TRIM.FaTE mercury case study described in Chapter 7. In addition, OAQPS recognizes the need for evaluation of specific model components and other aspects of the modeling system. Therefore, adjustments to the TRIM.FaTE module were made to increase the transparency of the module and to more readily allow for the testing of individual components within the module.

2.2 IS THE SPATIAL COMPARTMENTAL MASS BALANCE APPROACH COMMENSURATE WITH QUANTIFYING UNCERTAINTY AND VARIABILITY IN A SCIENTIFICALLY DEFENSIBLE MANNER?

COMMENT: In its review, SAB noted that, at that stage, it was not possible to indicate whether the spatial compartmentalization would be a significant source of uncertainty in generating predictions using TRIM, and added that this issue should be kept in perspective relative to other potential error sources. The SAB recommended that OAQPS conduct a thorough review of the available literature on sensitivity and uncertainty analysis prior to making choices on the specific approaches for incorporating sensitivity and uncertainty analysis into TRIM. Furthermore, SAB recommended that TRIM developers clarify how the analysis of uncertainty and sensitivity will be incorporated into TRIM and how it will be presented as part of the overall assessment. The SAB also stated that the role and limitations of sensitivity and uncertainty analysis be clearly recognized and acknowledged by TRIM developers and users.

RESPONSE: As part of the TRIM.FaTE evaluation plan (see Chapter 6), OAQPS is conducting structural evaluations on the effect of spatial configuration on model results. For example, the impact of compartment size, shape, and location on model outputs will be analyzed. These results will be considered along with those of other analyses as part of the TRIM.FaTE evaluation process.

The OAQPS has continued to review the available literature on sensitivity and uncertainty analysis for model parameters (see Appendix B), developed a general approach for uncertainty and variability analysis in TRIM (see Chapter 3), and developed a specific approach for incorporating sensitivity and uncertainty analysis capabilities into the TRIM.FaTE module – recognizing the roles and limitations of sensitivity and uncertainty analysis – as discussed further in Section 4.7 and in Chapter 6 of TRIM.FaTE TSD Volume I. The proposed approach reflects a balance between the additional effort needed in developing the module and the added value to the module. This approach includes adding the capability to present the results of uncertainty and variability analysis as part of an assessment using TRIM.FaTE. Plans for an uncertainty and variability analysis for a simplified environmental scenario are described in Chapter 6 of the TRIM.FaTE TSD Volume I and Chapter 7 of this report.

In the TRIM modeling system, the uncertainty and variability outputs from one module (*e.g.*, TRIM.FaTE) will be carried through to the other modules (*e.g.*, TRIM.Expo, TRIM.Risk). This feature will insure that TRIM outputs include measures of uncertainty and variability, which are important to the characterization of risks for the Agency's decision-making process.

COMMENT: The SAB noted that validation of TRIM is a difficult issue because TRIM will never be capable of (in)validation in the classical sense. Rather, the notion of model "validation" should be seen as a matter of designing a tool appropriate for the given (predictive) task. Accordingly, SAB recommended that history matching and qualitative peer review should not be set aside and that the Agency should watch for new methods for quantitatively assuring the quality of models as tools for fulfilling specified predictive tasks.

RESPONSE: A model evaluation plan has been developed for TRIM that will use a wide range of model evaluation tools to assess the quality, reliability, and relevance of TRIM and TRIM.FaTE (see Section 4.8 and Chapter 6). This plan includes some reliance on history matching and qualitative peer review. As new methodologies are developed and reviewed within the scientific community, OAQPS will be assessing their acceptance and usefulness for assuring the quality of TRIM and TRIM.FaTE.

2.3 IS THE OVERALL CONCEPTUAL APPROACH REPRESENTED IN THE TRIM.FaTE MODULE APPROPRIATE?

COMMENT: The SAB found that the TRIM.FaTE module is conceptually sound and aims at an appropriate level of complexity. The Subcommittee noted several strengths of the TRIM.FaTE module, including (1) meeting the requirements of scientific and technical defensibility, (2) flexibility, (3) ability to address exposures relevant to human health and ecological risk assessments, and (4) user friendliness. Limitations that were noted include (1) the use of confusing and contradictory terminology, (2) difficulty in understanding the difference between applications of the module in a screening capacity versus a more in-depth analysis mode, (3) the predisposition toward first-order, linear algorithms representing the fate and transport of chemicals, (4) the emphasis on the steady-state distribution of contaminants, and (5) the constraints and computational overhead associated with the spreadsheet software relied on for Prototype IV of TRIM.FaTE. The SAB also recommended providing examples of applications of the module and developing a user's guide that describes the proper use, strengths, and limitations of the TRIM.FaTE module.

RESPONSE: Recognizing the inconsistent and sometimes conflicting terminology used to describe the TRIM.FaTE prototype presented to SAB, OAQPS revised the terminology to be more consistent with other multimedia models. These revisions should help decrease confusion for both experienced and novice fate and exposure modelers. The new set of terms, which is used consistently throughout this report and the TRIM.FaTE TSD, is included in the glossary of each document.

One of the design objectives for the TRIM modeling system has been the ability to use it in performing iterative analyses. That is, the user is able to select the necessary level of analysis, ranging from a simple analysis, for which less site-specific data are required and which will run more quickly, to one needed for a more detailed risk assessment. For example, the more simple analysis, providing a more imprecise, general idea of pollutant distribution, may be sufficient for priority setting or other similar scoping activities (*e.g.*, in a screening analysis for which conservative default input parameters could be used). This allows the Agency to focus a more detailed analysis, where the impacts of parameter uncertainty may be assessed qualitatively for critical parameters, on situations where a more refined assessment is needed (*e.g.*, human health risk assessments to support environmental regulation).

Although it may appear that there is a predisposition toward using first-order, linear algorithms in TRIM.FaTE because of the use of LSODE (the Livermore Solver for Ordinary Differential Equations, a calculation tools used within TRIM.FaTE), the model is capable of using more complex, non-linear chemical mass transfer algorithms. The application of these higher order algorithms is limited, however, due to a lack of understanding in the scientific community regarding these chemical processes. Furthermore, the use of complex algorithms is sometimes limited because of the need to balance accuracy of outputs with the time needed to run the model.

It is probable that SAB's observation that TRIM.FaTE focuses on steady-state distributions of chemicals is due to the sample results that were presented at the May 1998 SAB meeting, which were virtually all steady-state results. However, the original and current intent of TRIM.FaTE is to develop a model that produces dynamic results. In the past year, the majority of work on TRIM.FaTE focused on presenting dynamic results.

The Agency's development of a computer framework for TRIM is described in Chapter 10. Consistent with the SAB recommendation, Version 1.0 of the framework has been developed primarily, but not entirely, in the Java programming language. Some parts are implemented in Fortran and others in C. The C programming language and Fortran are used in situations where existing code in those languages provides required functionality and where high computational efficiency is needed, such as solving systems of equations. Java provides portability across different hardware and operating systems and offers a good combination of speed of development, robustness, and support for object-oriented designs.

The model evaluation activities described in Chapter 6 and the experience gained through the mercury case study described in Chapter 7 will assist in describing appropriate uses of TRIM.FaTE and in identifying model limitations. The findings from these and other tests will be used to develop guidance for users of TRIM.FaTE, including guidance on the interpretation of results using linear algorithms. In addition, OAQPS is developing plans for providing training on the uses of TRIM and the individual modules.

2.4 THE TRIM APPROACH IS DESIGNED TO BE FLEXIBLE AND TO ALLOW FOR A TIERED APPROACH

2.4.1 IS THE TRIM.FaTE MODULE APPROPRIATE FROM A SCIENTIFIC PERSPECTIVE?

COMMENT: The SAB noted in its review of the prototype of TRIM.FaTE that it had not been checked against a detailed set of observed, spatially varying "real world" environmental concentration data. In addition, SAB stated that because of its highly aggregate representation of environmental compartments, it is unlikely that TRIM.FaTE can be effectively used to address fully variable three-dimensional spatial analyses and cited several other models that may offer greater value for certain applications.

RESPONSE: As discussed in Section 2.1, OAQPS developed a model evaluation plan and is conducting a case study using mercury which will include evaluating model results in comparison to monitoring data from a specific site. The TRIM system with its assumption of uniform distribution within a compartment may not effectively address fully variable three-dimensional spatial analyses *within a single compartment*. However, with TRIM's features promoting flexibility, it may be able to represent spatial variability *within a single medium* through the use of multiple compartments. The degree to which the spatial variability within a medium can be captured is dependent on the number of compartments into which that medium can be divided and the number of compartments that can be modeled. Recognizing the importance of this issue, one part of the TRIM.FaTE evaluation effort is to assess, through tests of varying spatial aggregation, the simulation of three-dimensional aspects.

It also should be noted that the Agency does not intend to rely solely on TRIM.FaTE in evaluating the multimedia impacts of air pollutants in support of regulatory and policy decisions. For those pollutants believed to have multimedia impacts, TRIM.FaTE analyses, including analyses of uncertainty and variability, along with other relevant information (including any limitations of the analyses), are intended to be used to inform those decisions. For pollutants for which a particular medium is dominant and for which transport and concentration gradients within that medium dominate the fate and exposure outcome, applicable single media, process-based models may be used to support decision-making.

COMMENT: The SAB noted that TRIM.FaTE lacked the ability to handle processes such as diffusive/dispersive transfer perpendicular to the longitudinal direction. Specifically, they cited the omission of dispersion phenomena throughout the module as an important issue that may limit the applicability and credibility of TRIM.FaTE.

RESPONSE: The EPA recognizes the need to incorporate such processes into the fate and transport module of TRIM and has conducted additional investigation into how this might be defensibly addressed within the current model architecture. At this time, these investigations have resulted in the inclusion of additional dispersion algorithms in surface water, as well as implementation of methods for including the results of external air models that do consider dispersion processes in TRIM.FaTE. However, due to the coupled relationship between compartments in TRIM.FaTE and the state of the science in characterizing air dispersion within grid models, dispersion and diffusion algorithms for air transport have not been included.

The structure of the currently implemented air model in TRIM.FaTE is that of a grid model, although it deviates from the traditional grid model used in air simulations for photochemical assessments in that the air compartment volume elements can be unequal in size and extent. Grid models have limitations with respect to characterizing dispersion. The homogeneous assumption used in grid models results in artificial (numerical) dispersion that tends to simulate the dilution of the material in the grid cell. For the typical grid cell on the order of several kilometers in size, it is this "artificial" dilution that is of much larger magnitude than the expected dispersion term. Thus, inclusion of an additional dispersion term may tend to over-dilute the plume. Further, the largest surface impacts can result from nonhomogeneous conditions (*e.g.*, asymmetric vertical mixing in convective conditions).

Due to these limitations, special dispersion characterizations are necessary with grid models, involving parameterizations for subgrid processes such as diffusion. Research indicates that there are few horizontal and vertical dispersion characterizations for grid models currently available. Further, it has been reported that numerical diffusion can dominate the physical diffusion predicted by these characterizations, especially in stable conditions (Nguyen et al. 1997). A method of addressing asymmetric vertical mixing during convective conditions has been explored by Pleim and Chang (1992). This approach will be investigated for inclusion in the TRIM.FaTE algorithm library.

An alternative to incorporating a more sophisticated air model into TRIM.FaTE is to import the results of such a model. The details for how this alternative can be accomplished are described in Appendix B of TRIM.FaTE TSD Volume I. As discussed in Appendix B, this approach has other limitations; notably, either the linkage between the external model and TRIM.FaTE is in one direction only and, hence, conservation of chemical mass is lost, or the external model must be linked with TRIM.FaTE in such a way that chemical transfer can occur in both directions. The difficulty of the latter will depend on the particular external model considered, but it is likely that it would generally require a substantial effort to implement. This is because the user must not only perform the practical tasks associated with computer programming, but also must ensure that no fundamental assumptions or concepts inherent to either model are violated. This could occur, for example, if there is overlap between the models in how they address other processes that are not an explicit component of the model linkage itself (*e.g.*, the external model may be treating deposition using general inputs for vegetative cover, and the user must implement additional checks to ensure that these inputs are consistent with the vegetative compartments used within TRIM.FaTE).

For cases where the lack of air dispersion modeling cannot be accepted, it is suggested that an external air model be used, the results of which would then be used as one of the inputs for TRIM.FaTE. The details of how this can be implemented have been developed (see Section 4.5, and Appendix B of the TRIM.FaTE TSD Volume I) and demonstrated using a common regulatory air model (Industrial Source Complex, Short Term Version 3, or ISCST3) (U.S. EPA

1995c). This approach is not limited to using air models alone, as the same method will work for any compartment type.

COMMENT: The SAB recommended that TRIM.FaTE be constructed to permit disaggregation of the component results and that the module be further studied to build confidence in the overall predictive ability of the model.

RESPONSE: As noted in Section 2.1, OAQPS recognizes the importance of the evaluation process for specific TRIM.FaTE components and other aspects of the modeling system and, therefore, made adjustments to TRIM.FaTE to allow for easier testing of individual components of the module.

COMMENT: The SAB suggested that tracking and accounting within the TRIM.FaTE module is needed to isolate its predictions and to permit benchmark comparison with data sets and other models. The Subcommittee noted that this would permit scrutiny of TRIM.FaTE transformation algorithms and the parameters that are used within this component of the TRIM model.

RESPONSE: The accessibility of the algorithm library for TRIM.FaTE permits scrutiny of the transformation and transfer algorithms selected for each modeling simulation. The initial process models and default parameters within TRIM.FaTE have been selected upon consideration of those available in existing models and the current modeling literature. The evaluation strategy proposed for TRIM.FaTE includes mechanistic evaluations to assess the individual process models. For example, OAQPS is performing a comparison of the TRIM.FaTE air transport component to a widely used EPA air dispersion model, ISCST3.

2.4.2 IS THE TRIM.FaTE MODULE AN APPROPRIATE TOOL FOR USE IN PROVIDING INFORMATION FOR REGULATORY DECISION-MAKING?

COMMENT: The SAB was unable to assess the appropriateness of the module as a decision-making tool because additional testing and evaluation are necessary.

RESPONSE: The OAQPS is conducting additional testing and evaluation of the TRIM.FaTE module, including testing against environmental concentration data and comparisons of outputs to other model results (see Chapters 6 and 7), and believes that TRIM.FaTE will be a useful tool that can provide information in support of regulatory decision-making.

2.5 DOES THE TRIM.FaTE MODULE, AS IT HAS BEEN CONCEPTUALIZED, ADDRESS SOME OF THE LIMITATIONS ASSOCIATED WITH OTHER MODELS?

COMMENT: While TRIM.FaTE includes the mass conserving feature for chemicals undergoing first-order linear mass transfer and transformation processes, SAB found it unclear as to how TRIM.FaTE can be adapted for chemicals that are subject to non-linear higher-order processes. The SAB recommended that additional methods and guidance be developed to assist users in selecting the appropriate level of spatial and temporal resolution necessary to obtain adequate precision and accuracy in the results.

RESPONSE: Thus far in the development of TRIM.FaTE, only first-order linear methods have been implemented for all fate and transport processes. The degree of additional effort required to incorporate non-linear and/or higher-order methods will depend on the types of methods of interest. For example, implementation of the types of equations used to model non-linear kinetics will be straightforward, as the original system of differential equations can be used, after adding the non-linear product terms. More care will be needed for incorporating methods for estimating gradients within what are currently assumed to be homogeneous compartments. The equation solving method used in TRIM.FaTE, LSODE, allows non-linear mass transfers to easily be set up numerically. The primary limitation TRIM.FaTE has for addressing such processes is a result of a lack of appropriate data, not a result of limitations in technical capability.

As part of the TRIM.FaTE mercury case study (see Chapter 7), OAQPS is conducting analyses to examine the level of spatial and temporal resolution necessary to obtain adequate precision and accuracy in the results for various Agency needs. The results of these analyses will assist OAQPS in the development of users guidance for the TRIM.FaTE module that will assist users in selecting an appropriate level of spatial and temporal resolution (see Chapter 5 of TRIM.FaTE TSD Volume I). The results of such testing and initial model applications will inform the guidance development process.

COMMENT: The SAB found that the flow model for air transport was highly simplified and recommended further evaluation of available air models and selection of additional process modules or components for incorporation into TRIM.FaTE.

RESPONSE: The EPA recognizes the need to incorporate more sophisticated methods for modeling air transport in TRIM.FaTE. Two primary means of doing so have been investigated since the May 1998 SAB review. The first option consists of incorporating algorithms for addressing dispersion/diffusion directly within the TRIM.FaTE algorithm library itself. The second option consists of ensuring that it is possible to use the results of an external air model that addresses these processes. Each of these approaches has drawbacks that limit its applicability within a coupled model such as TRIM.FaTE.

Incorporating horizontal and vertical air dispersion/diffusion algorithms directly within TRIM.FaTE was pursued using a method utilizing both lateral and vertical Pasquill-Gifford plume dispersion coefficients. However, review indicated that such methods are not preferable at this time (see the second response in Section 2.4.1). The alternative (*i.e.*, incorporating the results of an external air model that more appropriately addresses dispersion) has other limitations; notably, either the linkage between the external model and TRIM.FaTE is in one direction only and, hence, conservation of chemical mass is lost, or the external model must be linked with TRIM.FaTE in such a way that chemical transfer can occur in both directions. The difficulty of the latter will depend on the particular external model considered, but it is likely that it would generally require a substantial effort to implement. This is because the user must not only perform the practical tasks associated with computer programming, but also must ensure that no fundamental assumptions or concepts inherent to either model are violated. This could occur, for example, if there is overlap between the models in how they address other processes that are not an explicit component of the model linkage itself (*e.g.*, the external model may treat deposition using general inputs for vegetative cover, and the user must implement additional checks to ensure that these inputs are consistent with the vegetative compartments used within TRIM.FaTE).

The users guidance materials to be developed in the next TRIM development phase will caution users to carefully consider which external air models should be used as input to TRIM.FaTE. External models for various media can be used in lieu of the TRIM.FaTE algorithms; however, strong caution should be placed on the use of external models that themselves may not conserve mass (*e.g.*, Gaussian plume models), but whose use may be dictated or preferred for regulatory reasons.

COMMENT: The SAB noted that the predictive capability of the module is limited because of the gross transfer of mass between sources, receptors, and sinks. Therefore, it recommended comparing results from TRIM.FaTE to results from existing "single-media linked models" to establish the advantages and limitations of TRIM.FaTE.

RESPONSE: As part of the evaluation plan described in Chapter 6, OAQPS is testing TRIM.FaTE using monitoring data to compare model results to both "real world" observations and other model outputs, including those from the Agency's Indirect Exposure Methodology (IEM, now termed Multiple Pathways of Exposure or MPE), which is a methodology that relies on a one-way transport process through a series of linked models or algorithms. In addition, outputs from the TRIM.FaTE air modeling component are being compared to outputs from ISCST3. The ISCST3 is the air model relied upon in the MPE methodology.

COMMENT: With regard to uncertainty and sensitivity analyses, SAB recommended reviewing the literature on sensitivity and uncertainty analysis (see Section 2.2 for additional details).

RESPONSE: As noted in Section 2.2, after reviewing the literature (see Appendix B), OAQPS developed a proposed approach to incorporate sensitivity and uncertainty analysis capabilities into the TRIM computer framework. This approach is described in Chapter 3. In addition, implementation of the approach in the TRIM.FaTE module is summarized in Section 4.7 and described in more detail in Chapter 6 of TRIM.FaTE TSD Volume I.

2.6 DOES THE TRIM.FaTE MODULE, AS IT HAS BEEN CONCEPTUALIZED AND DEMONSTRATED TO DATE, FACILITATE FUTURE INTEGRATION WITH APPROPRIATE DATA SOURCES AND APPLICATIONS?

COMMENT: The SAB found that TRIM.FaTE could conveniently and effectively be integrated with data sources such as GIS, but that coupling of TRIM.FaTE with other more complex models that generate continuous spatial gradients may be problematic.

The SAB noted that the results from TRIM.FaTE would not be directly usable for human health assessments because TRIM.FaTE does not generate distributions of indoor air pollutants, which are the most important input for TRIM.Expo.

RESPONSE: The TRIM.FaTE module was never intended to solely support human health assessments, but only to generate estimates of concentrations in the various environmental and biotic media. The exposure component is critical for any human health assessment. Distributions of indoor air pollutants are not generated in TRIM.FaTE because it was determined that on a total mass basis, the indoor environment represents a negligible reservoir of mass of air pollutants. However, OAQPS recognizes the importance of indoor air pollutant concentrations to human exposure. For that reason, indoor air concentrations will be generated within the TRIM.Expo module by accounting for penetration of pollutants in the ambient air (obtained from output of TRIM.FaTE, from other air models, or from analysis of ambient monitoring data) indoors as well as significant indoor sources. Therefore, distributions of indoor air concentrations and exposures will be generated within the TRIM.Expo module.

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